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PERSPECTIVE

THE SUCCESS OF FAILED *HOMO SAPIENS* DISPERSALS OUT OF AFRICA AND INTO ASIA

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THE SUCCESS OF FAILED *HOMO SAPIENS* DISPERSALS OUT OF AFRICA AND INTO ASIA

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The evidence for an early dispersal of *Homo sapiens* from Africa into the Levant during Marine Isotope Stage 5 (MIS-5) 126-74 ka (thousand years age) was characterised for many years as an 'abortive' expansion: a pre-cursor to a sustained dispersal from which all extant human populations can be traced. Recent archaeological and genetic data from both western and eastern parts of Eurasia and from Australia are starting to challenge that interpretation. This short paper reviews current evidence for a scenario where the MIS-5 dispersal encompassed a much greater geographic distribution and temporal duration. The implications of this for tracking and understanding early human dispersal in Southeast Asia specifically are considered, and the validity of measuring dispersal success only through genetic continuity into the present is examined.

The recovery of early *Homo sapiens* fossils from sites in the Wadi-el-Mughara of northern Israel, initiated by Garrod in the late 1920's, and at Qafzeh cave in lower Galilee by Neuville (1932-1935) and Vandermeersch (1965-1979), provided rich grounds for investigating historical questions about the role of the Levant in late human evolution and its use as a corridor for Upper Palaeolithic dispersal into western Europe[1,2]. A suite of radiometric dates obtained at these sites over the last 25 years, however, has consistently placed their occupation within MIS-5[3-8]. The recent discovery of a human calvarium that has been

provisionally dated to 54.7±5.5 ka (all dates in this paper are in calendrical years unless otherwise stated) from Manot Cave, Israel, an which bears morphological affinity to European Upper Palaeolithic populations may be a sign that the full picture of this geographic relationship has yet to emerge[9]. The Skhūl and Qafzeh fossils remain, however, chronologically remote from the earliest appearance of *H. sapiens* in Eurasia, currently thought to be *c.* 47 ka or slightly earlier[10]. Uranium-series (U-Series) and Electron Spin Resonance (ESR) direct-dating of the Skhūl II and V skeletons suggests that burial took place $98^{+19/-10}$ ka[4]. At Qafzeh, the fossil-bearing stratigraphy (Layers XVI-XXI) has returned U-Series dates of 103±19 ka and 105±02 ka[5], and Thermoluminescence (TL) dates on burnt flints (Layers XVII-XXIII) of between 82.4±7.7 ka and 109.9±9.9 ka[8].

A clear separation between an initial and then later sustained dispersals of early *H. sapiens* into Eurasia also features prominently in our expanding genetic coverage of early humanity. On these grounds there continues to be confidence in the assertion that MIS-5 migrants did not contribute to the extant human genepool[11-13]. Both the genetic and the archaeological evidence have tended to support an interpretation that the Levantine palaeo-deme represented a precociously early, geographically local and ultimately ill-fated dispersal from Africa[14-16]. Worsening climate is often cited as an explanatory driver that prompted either range contraction back into the African continent, or else extirpation of this population[16,17]. As the early story of our species continues to be uncovered, humanity's initial emergence and spread even within this one continent, though, is becoming increasingly complex, ancient and pan-African in perspective[18-20]; potential indications that whatever the narrative of our wider dispersal, we should expect it to be similarly multifarious.

69 It was speculated some time ago that the early *H. sapiens* record from the Levant
70 could have been part of a wider migration[7]. Under that scenario, the disappearance of
71 groups from the Levant need not necessarily have signalled range contraction or extra-
72 African extinction. The extent and longevity of such a dispersal, particularly if it was
73 ultimately un-sustained, would raise important questions about the assumed link between
74 anatomically modern human behavioural capacity and our global diaspora; and more
75 fundamentally, about how we should measure evolutionary success. Data now
76 accumulating from across Eurasia, and particularly from Southeast Asia (Sunda) and
77 Greater Australia (Sahul) (Fig. 1, Table 1), make it feasible to entertain such a possibility
78 more seriously and to consider its implications.
79
80 Fig. 1, map showing the location of sites discussed in the text. See Table 1 for the list of locations and a
81 breakdown of the associated evidence as illustrated on the map.
82
83 Table 1, Archaeological, fossil and genetic evidence from sites discussed in the text and presented in
84 Fig. 1. (Note that the type of finds listed does not necessarily constitute the sum of evidence recovered
85 from any given site.)

Site number	Site name	Type of find
1	Wadi-el-Mughara + Qafzeh	Hominin fossils
2	Manot Cave	Hominin fossil
3	MDF-61	Stone tools (Middle Palaeolithic – MP)
4	Jebel Qattar 1	Stone tools (MP)
5	Kachchh Peninsula	Stone tools (MP)
6	Katoati	Stone tools (MP)
7	Jwalapuram 3	Stone tools (MP)
8	Callao Cave	Hominin fossil

9	Tam Pa Ling	Hominin fossils
10	Lida Ajer	Hominin fossil
11	Madjedbebe	Edge ground stone tools, plant processing
12	Tabon Cave	Hominin fossils
13	Niah Caves	Hominin fossils, plant processing
14	Warratyi rock shelter	Stone tools
15	Riwi Cave	Marine fauna (shell)
16	Hang Thung Binh 1	Marine fauna (shell –river mouth)
17	Phia Vai Cave	Marine fauna (shell)
18	Golo Cave	Marine fauna (shell)
19	Leang Timpuseng	Rock art
20	Jerimalai rock shelter	Marin fauna
21	Matja Kuru 2	Hafted bone point
22	Fuyan Cave	Hominin fossils
23	Punung III	Hominin fossil
24	Denisova Cave	Hominin DNA
25	Vindija Cave	Hominin DNA
26	Mal'ta	Hominin DNA
27	Ust'-Ishim	Hominin DNA
28	Kostenki	Hominin DNA
29	Tianyuan Cave	Hominin DNA
30	Darra-i-Kur	Hominin DNA
31	Chertovy Vorota	Hominin DNA

86

87 **Coastal environments and sustained dispersal**

88 Population genetics drawn from extant study groups and pioneered in the late 1980s[21] has
89 revealed an increasingly complex picture of our early global dispersal. The shift in

processing scale and the results emerging from ~~of~~ nuclear and whole genome sequencing in just the last five years (compared to older mtDNA and Y-chromosome studies), and the burgeoning field of ancient DNA (aDNA) analysis, are overturning many previous preconceptions[22]. Similarity in the modelled depth of genetic lineages among modern Southeast Asian and Australian aboriginal groups compared to those in Africa, together with archaeological evidence for the initial occupation of Australia during the first half of MIS-3 (59-29 ka) encouraged a rapid dispersal model to be advanced[23]. This model proposes that the first successful spread of *H. sapiens* followed the southern coasts of the Indian Ocean[12,24-27] and has been termed the 'Southern Route Dispersal Hypothesis'[28,29]. Opinion is divided as to the timing and nature of this proposed colonising pulse. Support is still found among some genetic studies for a single successful dispersal, taking place after the supposedly abortive Levantine episode and within a time window 65-55 ka[13,30]. Others argue either, for an earlier spread into the Middle East[31] or for multiple dispersals across Eurasia[25,32,33], following both southern and potentially northern routes during or before this period. While the rate of genetic advances has been impressive, the rate of archaeological and fossil discoveries has kept pace, though they do not yet mutually reinforce the genetic story in all respects. Indeed they raise significant doubts, if not about a Southern Route model itself, then at least about the simplicity of how it has tended to be presented.

Early Upper Pleistocene sites recently excavated in the Nefud Desert and Empty Quarter of Saudi Arabia (e.g. MDF-61) have been found to contain Levallois technology with affinities comparable to stone tool industries found at sites in the Levant, North Africa and South Asia[34-36]. A long history of episodic occupation within the Arabian interior has been proposed to have likely coincided with pluvial intervals and the expansion of regional rivers and lacustrine systems. The exploitation of inland waterways (as evidenced, for example, at

Jebel Qattar 1, 500 km from the nearest coast) makes a purely coastal dispersal mechanism for early modern human groups (if these were indeed *H. sapiens* as the researchers suspect) less likely than once thought[35].

Further to the east, recent survey work on the Kachchh Peninsula, Gujarat (India) – a locale chosen because of its strategic and ecologically favourable position for coastal dispersal – found no substantive evidence for marine exploitation, and a stone tool record from Upper Pleistocene contexts that was in close accordance with the South Asian Middle Palaeolithic. Late Palaeolithic industries that might be been attributed to an early MIS-3 dispersal into the subcontinent were absent[37]. Coastal or not, the possibility of an MIS-5 expansion as far as South Asia – potentially in evidence at sites such as Katoati (95.6±13.1 ka) in the north eastern part of the Thar Desert, and later from the Jwalapuram 3 locality (*77*±6 ka) in the Jurreru Valley – has been proposed on archaeological and palaeoenvironmental grounds[38-40].

A Southern Route coastal dispersal model also sits somewhat uneasily with the Southeast Asian and Australian records. Leaving aside the taxonomically ambiguous hominin evidence from Callao Cave[41], the earliest directly-dated evidence of less equivocal *H. sapiens* remains – a partial cranium and complete mandible from Tam Pa Ling, Laos (63-46 ka)[42,43]; together with an upper central incisor and M^2 from Lida Ajer, Sumatra (68±5 ka)[44]; as well as the new Optically Stimulated Luminescence (OSL) chronology from the non-fossil site of Madjedbebe in Arnhem Land, Australia (*c*. 65 ka)[45] – point to an expansion from Africa commencing already at the older end of the range proposed by modern genetic studies, if not earlier. This would have been very close to the age of the Toba super volcanic eruption *c*. 73 ka[46], making it a possible driver, though opinion continues to be divided about the effect that Toba is likely to have had on early human populations[47-49].

138 The relationship between coastal proximity and coastal exploitation is also by no
139 means a straightforward one. Palaeolithic sites located on the coast may show little or no
140 evidence of marine exploitation[37,39], and even in an insular region like Southeast Asia, there
141 may be a time-lag between access to and incorporation of coastal resources into economic
142 systems[50]. The effect of post-glacial inundation on coastal geography and occupation of
143 Pleistocene coastlines is likely to have been considerable, especially in Southeast Asia[51,52].
144 What is apparent, however, is that the earliest sites here, particularly those containing
145 human remains, are often located a considerable distance inland.

146 While there is currently no formal consensus about what should constitute an
147 effective foraging radius under tropical conditions specifically, ethnographic evidence
148 suggests a coastal zone of exploitation of 5-11 km, with more targeted, logistical expeditions
149 might range up to 30 km from a residential base[53,54]. None of the earliest fossil-bearing sites
150 in Southeast Asia, thought to reflect *H. sapiens* movement into the region, fall into that range.
151 For example, Tabon Cave on Palawan Island, in the Philippines (*c*. 48 ka), was perhaps the
152 closest: roughly 40 km at -120 m sea level, but remains without evidence of maritime
153 exploitation until the Holocene[55,56]. Lida Ajer[44] is *c*. 60 km inland from the modern coast. The
154 Niah Caves, from where the 'Deep Skull' has been directly-dated (by U-Series) to
155 approximately 35 ka, and associated archaeological remains to >46 ka[57,58], are situated on the
156 northern Borneo coastal plain, but would have been up to *c*. 80 km from the sea for much of
157 the last glacial period[59]. Tam Pa Ling is approximtely 265 km from the nearest modern coast.

158 This is not to say that there was no contact between the coast and these hinterlands.
159 People or materials were at least periodically moving considerable distances in both
160 directions by the later millennia of the Pleistocene. For example, in Australia, the antiquity
161 of evidence from the Warratyi rock shelter (46-49 ka) implies that dispersal into this

continent probably took a direct north-south route rather than exclusively hugging the coast, and potentially followed or was tied to the resources of river and lake systems in the interior[60]. At the site of Riwi, in north western Australia, fragments of marine *Dentalium* sp. shell, possibly worked into beads, date from 42-29 uncal. ka (uncalibrated ^{14}C) approximately 300 km from modern coast[61]. In northern Vietnam, excavations by the author at Hang Thung Binh 1 have included recovery of a perforated Neritidae (*Neripteron violacea*) shell (Fig. 2). This species favours brackish, transgressive environments, such as those close to river mouths, but was found in a context dating to immediately after the Last Glacial Maximum: *c*. 17.5 ka, when the coast was as much as 500 km away[62]. Also from northern Vietnam and a similar distance from the modern coast, cowrie shells have been found placed into the eye sockets of an undated but probably mid-Holocene burial excavated at Phia Vai[63].

Fig. 2, Excavations at Hang Thung Binh 1, Tràng An, Ninh Binh province, Vietnam. Inset: perforated Neritidae (*Neripteron violacea*) shell, scale: 5 mm (images: R. Rabett & T. Kahlert).

There is also no argument that fully maritime activity would have been required during the Upper Pleistocene to reach Sahul[64,65] and many parts of island Southeast Asia, such as the North Malaku archipelago (Golo Cave, Gebe Island – 32-29 uncal. ka)[66], or Sulawesi (Leang Timpuseng – 39.9 ka)[67]. The same could be said for access to the island of Luzon in the Philippines (Callao Cave – 67 ka), though the identity of the hominin responsible for the archaeological record here has not yet been assigned with certainty to *H. sapiens*[41]. Pleistocene deposits at the Jerimalai rock shelter on the east coast of East Timor, dated to approximately 42 ka[68], contain a comparatively abundant and well-preserved faunal assemblage dominated by marine taxa. Among these, turtles and fish – including

187 fragments from large pelagic species such as tuna – are particularly prominent. The rapid
188 coastal drop-off along this coast will have meant that at no point in its occupational history
189 was the site more than *c*. 5 km from the sea, making it one of the few locations across the
190 region where initial Pleistocene colonisation might be preserved. The age of the site,
191 however, does not equal the earliest evidence of proposed occupation on East Timor[69],
192 regionally[43,58] or in Australia[45,60,65]. This leaves Jerimalai as a tantalising but not necessarily
193 true reflection of the habits of the earliest colonists to pass through. A fragment of bone
194 hafting technology – possibly from a projectile – recovered at neighbouring Matja Kuru 2
195 dates to a similar time: 36.5-34.5 ka[70]. This might further attest to the early existence of a
196 projectile technology capable of exploiting marine resources, though here too the link
197 remains unproven and the dates are still comparatively young, relative to any modelled
198 dispersal pulse.

199 Currently, such evidence as there is for maritime activity along the Southern coastal
200 Route is notable for being heavily weighted towards data coming from Southeast Asia; a
201 region of the world whose geographic history has been defined by periods of inundation
202 and insularity through-out the Pleistocene and Holocene. As such the records as exist may
203 be more representative of adaptive solutions that were particular to this region. Erlandson &
204 Braje have proposed that productive mangrove forests and other estuarine habitats situated
205 along the southern ocean coasts could have provided significant resource opportunities to
206 aid foragers[71], in an extension of their 'kelp-highway' model for coastal migration around
207 the North Pacific[72]. While early use of mangrove forests has been discussed and found to be
208 plausible during from the Early Holocene onwards in Southeast Asia[73], the underlying issue
209 does not relate so much to specific habitats or their capacity to speed or facilitate dispersal;
210 at issue is a more far-reaching assumption.

One of the features of the Southeast Asian archaeological record is the limited evidence for a pioneer phase of settlement[56,69,74]. The West Mouth sequence at the Niah Caves (figure 3), one the richest and most extensively studied early *H. sapiens* sites in the region[57,58,75], is illustrative of this. From its deepest archaeological contexts there is every indication that those visiting this site belonged to a population that were already comprehensively adapted to the restrictions and affordances of lowland rainforest conditions, be that through the consumption of nuts, such as from *Pangium edule* (Achariaceae) – a tree closely related to Salicaceae (willow/poplar family) – which need to be detoxified before consumption, to the presence of sago and yam starch granules[76], to the use of plant-based pigments[77] and effective hunting and probably trapping strategies[78]. There could be various explanations for this. Landscape-learning may have occurred comparatively quickly upon arrival into Southeast Asia, even in the context of hugely diverse tropical environments – such as has been proposed for early human presence in Sri Lanka[79]. Alternatively, knowledge acquired *en-route* could have been cumulative and so only needed to be moderately expanded upon arrival at any new location. Issues of archaeological survey and recovery bias could also still be affecting perceived patterns.

Fig. 3, The West Mouth of the Niah Caves. The principal archaeological investigations took place within the compound (right of picture) (image: G. Barker).

The fact remains that all sites attributed to Pleistocene *H. sapiens* in South Asia and particularly Southeast Asia and Australia are still assumed to have been produced during the same uniparental and genetically successful (i.e. still visible in contemporary human populations) dispersal wave out of Africa. This scenario continues to be speculative, and emerging lines of archaeological and genetic evidence are calling it into question. The notion

236 that coastal environments between Africa and Sahul might facilitate rapid dispersal has
237 provided a convenient solution to tie together geographically remote yet chronologically
238 similar datasets, particularly genetic datasets. The evidence on the ground, though, does not
239 support such a singular or straightforward explanation.
240
241 **Inherited complexity**
242 In mainland Asia, there is a growing list of fossil remains from sites in the southern and
243 central provinces of China that purport to contain the remains of *H. sapiens* dating from 125-
244 68 ka[80-82]. They include the widely publicised recent discovery of 47 teeth (though without
245 any associated archaeology) from the site of Fuyan Cave, Hunan province[83]. The credibility
246 of these continues to receive a mixed reception[84,85], with questions of authenticity being
247 raised on geochronological or taphonomic grounds. Further to south, within the Sundaland
248 extension of Pleistocene mainland Asia, a possible *H. sapiens* P^3 (PU-198) has been reported
249 in association with the first appearance of fully modern rainforest taxa (Punung Fauna) on
250 Java[86], provisionally dated to between 128±15 and 118±3 ka[87] (contingent upon changes in
251 Java's insularity[56]). This catalogue of osteological evidence raised the possibility of a
252 complex history underpinning early *H. sapiens* populations in eastern Eurasia; something
253 that is also starting to become apparent through the steady publication of extinct human
254 genomes[88-90].
255 The publication in 2010 of mtDNA evidence of an unknown hominin at the Siberian
256 Altai site of Denisova cave[91] has been swiftly followed by considerable widening of the
257 geographic coverage over which 'Denisovan' genetic ancestry can be traced. In addition to
258 substantial (*c.* 1.2%) ancestral gene flow in New Guinean, Australian and Oceanian groups
259 east of the biogeographic Wallace Line, together with genetic signals for later episodes of

admixture with mainland Southeast Asian modern human groups[92-95], a weaker but widely occurring signal has now been identified in a number of different modern South Asian populations[96]. In 2016 a study hinting that *c.* 2 % of the modern Papuan genome may have originated from an extinct expansion out of Africa[25] has not yet been replicated[12,97]; however, other complementary data are starting emerge. For example, the Neanderthal genome sequence obtained from remains in Denisova Cave similarly points to introgression of DNA from a *H. sapiens* population that is likely to have diverged from other African groups before the genetic ancestor of all modern non-Africans[98]. These findings further diminish the likelihood that a neatly uniparental dispersal out of Africa was the sole source of early human occupation in eastern provinces of Asia, Southeast Asia or Sahul.

The study of aDNA is providing a critical reassessment of genetic patterns and models constructed from contemporary populations alone and revealing levels of admixture and isolation between ancient and ancestral populations hitherto unseen[94,95,99,100]. Coverage relating to the period of early human dispersal, however, is still limited and unevenly distributed geographically. Considerable attention has been directed towards fossil remains from higher mid-latitude western and northern Eurasian sites since 2010, when DNA recovered from hominin bones at Vindija Cave (Croatia) and Denisova Cave hailed the first strong evidence for low levels of gene flow from archaic forms to *H. sapiens*[101,102] (though, in the case of Vindija, new direct dates cast some doubt on this[103]). High coverage genome sequences have lately been recovered from a Denisovan individual[104] and a Neanderthal[105], both from Denisova Cave. Ancient genomes have also been recovered from the remains of early *H. sapiens* at three sites: a juvenile individual (MA-1) from Mal'ta in south-central Siberia (approximately 24 ka)[106]; a left femoral fragment from Ust'-Ishim in western Siberia (45-43 ka)[107]; and from Kostenki on the Central Russian Plain, where DNA was extracted

from the left tibia of the Kostenki 14 skeleton (38-36 ka)[100]. MtDNA and a partial nuclear genome has also been recovered from the lower limb bones of a Pleistocene-aged skeleton at Tianyuan Cave, 50 km southwest of Beijing and dated from 40-37.6 Ka[108].

By comparison, our understanding of human dispersal from lower mid- and low latitude Eurasian sites through aDNA is for the present largely restricted to material from later periods. For example, Douka *et al*. have provided a chronological reassessment and mitochondrial genome from a human temporal bone at Darra-i-Kur, Afghanistan that had been of presumed Pleistocene antiquity[109]. Their study produced a much younger age of approximately 4.5 ka, suggesting that the bone was likely intrusive from Neolithic levels at the site. Siska *et al*. have presented genomes for two individuals from Chertovy Vorota (Devil's Gates) in Russia's Primorye Province[110]. These again date to the Neolithic (approximately 7.7 ka) and exhibit limited affinity to other published ancient genomes. Finding depositional contexts that are conducive to the preservation of aDNA presents a formidable challenge, particularly at tropical latitudes[88], and one that is compounded by a general paucity of available fossils. A recent study of geoarchaeological considerations in the Southeast Asian tropics lists only 17 Pleistocene-age hominin fossil-bearing sites between the Southern Chinese provinces and Flores (a distance of more than 3500 km)[111]. None of these has as yet yielded viable aDNA, though efforts are on-going.

Although equally at the mercy of the preservation environment, pioneering work to extract hominin aDNA from sediment[112] is also set to enhance understanding of ancient populations, their nature and spread. This technique will offer an independent line of evidence to help assess site records, including those associated with dispersal claims, where osteological human remains are absent or sites that are controversial – such as the recent proposal of an MIS-5 butchery site in California[113,114]. Coupled with the resurgence of

308 archaeological investigation in eastern Eurasia since the 1990s, and the expanding number of
309 international collaborations in both fields, the potential for new discoveries is substantial.
310 The fundamental rethink of *H. sapiens* dispersal during MIS-5 that has been mooted for some
311 time[39,55,115-118] may now need to be addressed head-on.
312
313 **The implications of dispersal success and failure**
314 The genetic record of extant human populations continues to be equivocal about the number
315 and timing of successful dispersals episodes out of Africa, but consistently places such
316 movement in the later first half of the Upper Pleistocene. However, evidence is now
317 accumulating to suggest that whatever happened during that period may well have been
318 significantly underlain by an earlier expansion of our species during MIS-5[116]. Previously
319 portrayed as 'abortive', new archaeological and genetic research in Arabia, South and
320 Southeast Asia, Australia and China, gives reason to entertain the possibility that the MIS-5
321 phase of dispersal could have persisted beyond Africa for the best part of 70,000 years
322 (effectively the same time depth we ascribe to the antiquity of today's global population),
323 and could have taken human groups much further afield than previously thought. If this is
324 the case, it begs the question: should evolutionary success be measured only by genetic and
325 demographic continuity into the present?
326 A wider and more enduring MIS-5 dispersal of *H. sapiens* would have helped to
327 introduce the kind of fragmentary genetic legacy now accepted to have entered our genome
328 from archaic populations. Ultimately that branch of the *H. sapiens* line ended. Establishing
329 the cause of this could turn out to be one of the central questions for Palaeolithic
330 Archaeology and Palaeoanthropology in the coming years. Conceivably, extended isolation,
331 akin to that now proposed for Altai Neanderthal and Denisovan populations[98] could be

looked to as a factor. While there has been general acceptance that extinction will have been as large-a-driver as innovation has been in our evolutionary history[119], the complexities of population interaction and turnover are only now starting to be appreciated fully. Ancient DNA studies are unlocking assumptions about evolutionary affinities and are leading us to reassess archaeological explanations that have been shaped over the last thirty years by a one-sided genomic picture: the history of today's surviving global population.

The effect of early contact on the development and spread of cultural practice may have been no less far-reaching. Under this scenario, we would need to consider in detail the impact that the first 70,000 years of colonization might have had on resident archaic hominin populations and *their* trajectories, rather than attributing causes of change solely to interactions and conditions that arose subsequently. We do not know how events in the former contact period might have affected those in the latter, though the likelihood of early interbreeding between *H. sapiens* and Neanderthals[105] already points to its probable significance. We would need to re-examine the overlap between archaic hominins and anatomically modern humans from second half of the Pleistocene with the possibility that the 'newcomers' may not have been first *H. sapiens* to be met by archaic groups walking into the Eurasian interior or along its coasts. There is also the outside possibility that despite its remote divergence from extant modern human populations[102], a meaningful relationship may exist between the Denisovan signal and an early spread of ancient *H. sapiens*.

Finally, in the context of this paper, some of the earliest archaeological evidence attributed to *H. sapiens* and previously linked to a Southern Route colonization, may prove to be not only better explained by other routes of dispersal, they may also be a record of groups whose descendants did not extend forward through time to the present. The mixed picture of interior and coastal occupation that we have currently from Southeast Asia and

Sahul might be partly explained through a conflation of records. We need to consider the possibility that some current sites in the 45-65 ka range might represent late-surviving enclaves of earlier pioneer *H. sapiens* diaspora, by then in terminal decline, rather than all belonging to the same incoming spread; and that their extinction may even have been hastened by the arrival of people who looked very much like them.

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